What is Claimed:

1. An optical device, comprising:

a first conductive layer;

an optical layer, arranged over said first conductive layer, said optical layer being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a variable, substantially reversible, dopant concentration in said optical layer; and

a second conductive layer, arranged over a portion of said optical layer, in accordance with a predetermined pattern.

2. The optical device of claim 1, wherein a change in said index of refraction of said optical layer, due to a change in said dopant concentration, does not lead to a change in light absorption of said wavelength of interest, within said optical layer, by more than 10 %.

3. The optical device of claim 1, comprising at least one power source, in communication with said first and second conductive layers.

4. The optical device of claim 3, wherein said at least one power source includes at least two power sources, for selectively applying power to different segments of said second conductive layer.

5. The optical device of claim 3, and further including a control unit and electrical switches for selectively applying power to different segments of said second conductive layer.

6. The optical device of claim 3, wherein said optical layer has an initial uniform concentration of a dopant, and the application of an electric potential causes a substantially reversible gradient in dopant concentration to be formed, wherein said index of refraction is further a function of said dopant concentration gradient in said optical layer.

7. The optical device of claim 3, wherein said optical layer is operative as a first electrode in a chemical cell, and further including:

an ion-storage layer, operative as a second electrode in said chemical cell; and

an electrolyte layer, sandwiched between said optical and ion-storage layers,

wherein at least one layer selected from the group consisting of said optical layer, said ion storage layer, and a combination thereof, has an initial concentration of dopant, such that there exists a dopant concentration difference between said optical layer and said ion storage layer, and the application of an electric field will cause migration of the dopant between said optical and ion storage layers, resulting in a change in the index of refraction of said optical layer.

8. The optical device of claim 7, wherein said electrolyte layer is operative as a wave-guide, and said optical layer is operative as a Grating Wave-guide Coupler.

9. The optical device of claim 3, wherein said first conductive layer is operative as a wave-guide, and said optical layer is operative as a Grating Wave-guide Coupler.

10. The optical device of claim 3, operative to selectively form and selectively erase a wave-guide, within said optical layer.

11. The optical device of claim 3, operative to selectively form and selectively erase a grating, within said optical layer.

12. The optical device of claim 3, operative to selectively form and selectively erase a plurality of grating sets, within said optical layer.

13. The optical device of claim 3, operative to selectively tune an optical path length to a desired value.

14. The optical device of claim 3, operative as a wave-guide switch.

15. The optical device of claim 3, operative as a Mach-Zehndler Interferometer.

16. The optical device of claim 3, operative as an Array Wave-guide Grating.

17. The optical device of claim 3, operative as a Fresnel lens.

18. The optical device of claim 3, operative as a phase pattern for generating a hologram.

19. The optical device of claim 1, wherein said optical layer is formed of a material selected from the group consisting of V_2O_5, Ta_2O_5, MnO_2, CoO_2, NiO_2, Mn_2O_4, WO_3, TiO_2, MoO_3, IrO_7, a combination thereof, and a combination of the aforementioned oxides with cerium oxide.

20. The optical device of claim 1, wherein said optical layer is formed of silver doped $RbAg_4I_5$.

21. The optical device of claim 1, wherein said optical layer is formed of a material selected from the group consisting of silicon, and a silicon compound.

22. The optical device of claim 1, wherein said optical layer is formed of a polymer.

23. The optical device of claim 1, wherein said optical layer is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

24. The optical device of claim 1, wherein said optical layer is transparent in the x;z plane.

25. The optical device of claim 1, wherein said optical layer is transparent along the y axis.

26. The optical device of claim 1, wherein said device is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

27. The optical device of claim 1, wherein said device is transparent in the x;z plane.

28. The optical device of claim 1, wherein said device is transparent along the y-axis, perpendicular to said layers.

29. A method of selectively forming and selectively erasing an optical feature, comprising:

providing an optical device, which comprises:

a first conductive layer;

an optical layer, arranged over said first conductive layer, said optical layer being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a dopant concentration in said optical layer; and

a second conductive layer, arranged over a portion of said optical layer, in accordance with a predetermined pattern; and

applying an electric potential between said first and second conductive layers, thus causing a reversible change in said index of refraction within said optical layer between said portion and the remainder of said optical layer.

30. The method of claim 29, and further including maintaining a change in light absorption of said wavelength of interest, within said optical layer, at ± 10 %.

31. The method of claim 29, wherein applying said electric potential

includes applying with at least one power source, in communication with said first and second conductive layers.

32. The method of claim 31, wherein said at least one power source includes at least two power sources, for selectively applying said electric potential to different segments of said second conductive layer.

33. The method of claim 31, and further including employing a control unit and electrical switches, for selectively applying said electric potential to different segments of said second conductive layer.

34. The method of claim 31, wherein said optical layer has an initial uniform concentration of a dopant, and the application of an electric potential causes a substantially reversible gradient in dopant concentration to be formed, wherein said index of refraction is further a function of said dopant concentration gradient in said optical layer.

35. The method of claim 31, wherein said optical layer is operative as a first electrode in a chemical cell, and further including:

an ion-storage layer, operative as a second electrode in said chemical cell; and

an electrolyte layer, sandwiched between said optical and ion-storage layers,

wherein at least one layer selected from the group consisting of said optical layer, said ion storage layer, and a combination thereof, has an initial concentration of dopant, such that there exists a dopant concentration difference between said optical layer and said ion storage layer, and the application of an electric field will cause migration of the dopant between said optical and ion storage layers, resulting in a change in the index of refraction of said optical layer.

36. The method of claim 35, wherein said electrolyte layer is operative as a wave-guide, and said optical layer is operative as a Grating Wave-guide Coupler.

37. The method of claim 31, wherein said first conductive layer is operative as a wave-guide, and said optical layer is operative as a Grating Wave-guide

Coupler.

38. The method of claim 31, and further including selectively forming and selectively erasing a wave-guide, within said optical layer.

39. The method of claim 31, and further including selectively forming and selectively erasing a grating, within said optical layer.

40. The method of claim 31, and further including selectively forming and selectively erasing a plurality of grating sets, within said optical layer.

41. The method of claim 31, and further including tuning an optical path length to a desired value.

42. The method of claim 31, and further including operating as a wave-guide switch.

43. The method of claim 31, and further including operating as a Mach-Zehndler Interferometer.

44. The method of claim 31, and further including operating as an Array Wave-guide Grating.

45. The method of claim 31, and further including operating as a Fresnel lens.

46. The method of claim 31, and further including operating as a phase pattern for generating a hologram.

47. The method of claim 29, wherein said optical layer is formed of a material selected from the group consisting of V_2O_5, Ta_2O_5, MnO_2, CoO_2, NiO_2, Mn_2O_4, WO_3, TiO_2, MoO_3, IrO_7, a combination thereof, and a combination of the aforementioned oxides with cerium oxide.

48. The method of claim 29, wherein said optical layer is formed of silver doped $RbAg_4I_5$.

49. The method of claim 29, wherein said optical layer is formed of a material selected from the group consisting of silicon, and a silicon compound.

50. The method of claim 29, wherein said optical layer is formed of a polymer.

51. The method of claim 29, wherein said optical layer is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

52. The method of claim 29, wherein said optical layer is transparent in the x;z plane.

53. The method of claim 29, wherein said optical layer is transparent along the y axis.

54. The method of claim 29, wherein said device is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

55. The method of claim 29, wherein said device is transparent in the x;z plane.

56. The method of claim 29, wherein said device is transparent along the y-axis, perpendicular to said layers.

57. An optical device, comprising:

a first conductive layer;

an optical layer, arranged over said first conductive layer, said optical layer being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a variable, substantially reversible, dopant concentration in said optical layer; and

a second conductive layer, arranged over said optical layer,

wherein a change in said index of refraction of said optical layer, due to a change in said dopant concentration, does not lead to a change in light absorption of said wavelength of interest, within said optical layer, by more than 10 %.

58. The optical device of claim 57, comprising at least one power source, in communication with said first and second conductive layers.

59. The optical device of claim 58, wherein said at least one power source includes at least two power sources, for selectively applying power to different segments of said second conductive layer.

60. The optical device of claim 58, and further including a control unit and electrical switches for selectively applying power to different segments of said second conductive layer.

61. The optical device of claim 58, wherein said optical layer has an initial uniform concentration of a dopant, and the application of an electric potential causes a substantially reversible gradient in dopant concentration to be formed, wherein said index of refraction is further a function of said dopant concentration gradient in said optical layer.

62. The optical device of claim 58, wherein said optical layer is operative as a first electrode in a chemical cell, and further including:

an ion-storage layer, operative as a second electrode in said chemical cell; and

an electrolyte layer, sandwiched between said optical and ion-storage layers,

wherein at least one layer selected from the group consisting of said optical layer, said ion storage layer, and a combination thereof, has an initial concentration of dopant, such that there exists a dopant concentration difference between said optical layer and said ion storage layer, and the application of an electric field will cause migration of the dopant between said optical and ion storage layers, resulting in a change in the index of refraction of said optical layer.

63. The optical device of claim 58, operative as a tunable spacer layer sandwiched between two quarter-wave stacks, to form a tunable interference filter.

64. The optical device of claim 57, wherein said optical layer is formed of a material selected from the group consisting of V_2O_5, Ta_2O_5, MnO_2, CoO_2, NiO_2, Mn_2O_4, WO_3, TiO_2, MoO_3, IrO_7, a combination thereof, and a combination of the aforementioned oxides with cerium oxide.

65. The optical device of claim 57, wherein said optical layer is formed of silver doped $RbAg_4I_5$.

66. The optical device of claim 57, wherein said optical layer is formed of a material selected from the group consisting of silicon, and a silicon compound.

67. The optical device of claim 57, wherein said optical layer is formed of a polymer.

68. The optical device of claim 57, wherein said optical layer is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

69. The optical device of claim 57, wherein said optical layer is transparent in the x;z plane.

70. The optical device of claim 57, wherein said optical layer is transparent along the y axis.

71. The optical device of claim 57, wherein said device is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

72. The optical device of claim 57, wherein said device is transparent in the x;z plane.

73. The optical device of claim 57, wherein said device is transparent along the y-axis, perpendicular to said layers.

74. A method of selectively forming and selectively erasing an optical feature, comprising:

providing an optical device, which comprises:

a first conductive layer;

an optical layer, arranged over said first conductive layer, said optical layer being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a dopant concentration in said optical layer; and

a second conductive layer, arranged over said optical layer; and

applying an electric potential between said first and second conductive layers, thus causing a reversible change in said index of refraction within said optical layer between said portion and the remainder of said optical layer, while maintaining a change in light absorption of said wavelength of interest, within said optical layer, at ± 10 %.

75. The method of claim 74, and further including tuning a spacer layer, sandwiched between two quarter-wave stacks, to form a tunable interference filter.

76. A tunable optical filter, comprising:

alternate strata of indices of refraction of n_1 and n_2, said n_1 and n_2 being substantially different from each other;

conductive layers, arranged along the midst of each stratum; and

electrolyte layers, arranged between each of said stratum;

wherein said tunable filter is transparent to at least a wavelength of interest in the y direction, and wherein at least one tunable index of refraction, selected from the group consisting of n_1, n_2, and both n_1 and n_2 is a function of a variable, substantially reversible, dopant concentration of its associated stratum.

77. The tunable filter of claim 76, and further including at least one power source adapted to apply potential differences of alternating polarities to said conductive layers, wherein by said application, a migration of dopant across said electrolyte layers takes place, thus tuning said at least one tunable index of refraction.

78. The tunable filter of claim 77, and further including a plurality of power sources, for simultaneously applying said potential differences of alternating polarities to said conductive layers.

79. The tunable filter of claim 76, formed as a quarter-wave stack.

80. The tunable filter of claim 79, operative as a wavelength dielectric filter.

81. The tunable filter of claim 79, operative as a tunable interference filter.

82. The tunable filter of claim 79, operative as a tunable band pass filter.

83. The tunable filter of claim 79, operative as a tunable cutoff filter.

84. The tunable filter of claim 76, wherein said strata are formed of at least one material selected from the group consisting of V_2O_5, Ta_2O_5, MnO_2, CoO_2, NiO_2, Mn_2O_4, WO_3, TiO_2, MoO_3, IrO_7, a combination thereof, and a combination of the aforementioned oxides with cerium oxide.

85. The tunable filter of claim 76, wherein said strata are formed of silver doped $RbAg_4I_5$.

86. The tunable filter of claim 76, wherein said strata are formed of at least one material selected from the group consisting of silicon, and a silicon compound.

87. The tunable filter of claim 76, wherein said strata are formed of at least one polymer.

88. The tunable filter of claim 76, wherein said alternating strata are formed a same material, having different initial dopant concentrations.

89. The tunable filter of claim 76, wherein said alternating strata are formed of different materials.

90. The tunable filter of claim 76, wherein said filter is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

91. The tunable filter of claim 76, wherein said filter is transparent in the x;z plane.

92. A method of producing a tunable filter, comprising:

arranging alternate strata of indices of refraction of n_1 and n_2, said n_1 and n_2 being substantially different from each other, wherein at least one index of refraction, selected from the group consisting of said n_1, said n_2, and said n_1 and n_2 is a function of a variable, substantially reversible, dopant concentration of its associated stratum;

arranging conductive layers, along the midst of each stratum;

arranging electrolyte layers, between each of said stratum; and

applying potential differences of alternating polarities to said conductive layers, wherein by said application, a migration of dopant across said electrolyte layers takes place, thus tuning said at least one tunable index of refraction.

93. The method of claim 92, wherein said tunable filter is formed as a quarter-wave stack.

94. A tunable optical filter, comprising:

a stack of optical layers, said optical layers being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a variable, substantially reversible, dopant concentration gradient in said optical layer; and

conductive layers, arranged between said optical layers.

95. The tunable filter of claim 94, and further including at least one power source adapted to apply potential differences of alternating polarities to said conductive layers, wherein by said application, a concentration gradient of dopant is formed within each of said optical layers, thus tuning said filter.

96. The tunable filter of claim 95, and further including a plurality of power sources, for simultaneously applying said potential differences of alternating polarities to said conductive layers.

97. The tunable filter of claim 94, formed as a quarter-wave stack.

98. The tunable filter of claim 97, operative as a wavelength dielectric filter.

99. The tunable filter of claim 97, operative as a tunable interference filter.

100. The tunable filter of claim 97, operative as a tunable band pass filter.

101. The tunable filter of claim 97, operative as a tunable cutoff filter.

102. The tunable filter of claim 94, wherein said optical layers are formed of a material selected from the group consisting of V_2O_5, Ta_2O_5, MnO_2, CoO_2, NiO_2, Mn_2O_4, WO_3, TiO_2, MoO_3, IrO_7, a combination thereof, and a combination of the aforementioned oxides with cerium oxide.

103. The tunable filter of claim 94, wherein said optical layers are formed of silver doped $RbAg_4I_5$.

104. The tunable filter of claim 94, wherein said optical layers are formed of a material selected from the group consisting of silicon, and a silicon compound.

105. The tunable filter of claim 94, wherein said optical layers are formed of a polymer.

106. The tunable filter of claim 94, wherein said filter is transparent in a range selected from the group consisting of the ultraviolet range of 200 - 400 nm, the visible range of 400 – 800 nm, the near infrared range of 800 – 2000 nm, the mid infrared range of 2000 – 5000 nm, the telecommunication range of 1300 – 1600 nm, and a combination thereof.

107. The tunable filter of claim 94, wherein said filter is transparent in the x;z plane.

108. The tunable filter of claim 94, wherein said filter is transparent along the y-axis.

109. A method of producing a tunable filter, comprising:

stacking optical layers, said optical layers being transparent to at least a wavelength of interest and having an index of refraction, which is a function of a variable, substantially reversible, dopant concentration gradient in said optical layers;

arranging conductive layers, between said optical layers; and

applying potential differences of alternating polarities to said conductive layers, wherein by said application, a concentration gradient of dopant is formed within said optical layers, thus tuning said filter.

110. The method of claim 109, wherein said tunable filter is formed as a quarter-wave stack.